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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/791,597	03/02/2004	Brent Jerome Brunell	140228-1	3436

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GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
PATENT DOCKET RM. BLDG. K1-4A59
NISKAYUNA, NY 12309

EXAMINER	
KIM, TAE JUN	
ART UNIT	PAPER NUMBER
3746	

DATE MAILED: 11/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

6

Office Action Summary	Application No.	Applicant(s)	
	10/791,597	BRUNELL ET AL.	
	Examiner	Art Unit	
	Ted Kim	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *7/14/05 03/02/04*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. Applicant's lengthy IDS submissions filed 03/02/2004 and 07/14/2005 have been considered in the context of the time frame ordinarily permitted for examination.

Claim Objections

2. Claim 33 is objected to because of the following informalities: "control" is misspelled. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claim 1, 10-13, 16-20, 26-32, 35-38 are rejected under 35 U.S.C. 102(e) as being anticipated by Brunell et al (6,823,675). Brunell et al teach a system for controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: a state estimator (see Fig. 5; col. 8, lines 48+) adapted to estimate a state of said engine by estimating one or more unmeasured or unsensed parameters using data from said sensors of said engine for one or more

measured or sensed parameters, said estimator including a model (see Fig. 12) of said engine; and a control module adapted to generate commands for said actuators based on said state, said control module including an optimization algorithm (see optimizer in Fig. 12 and col. 9, lines 45+) for determining said commands; a method of controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: receiving data from said sensors of said engine for one or more measured or sensed parameters; estimating a state of said engine by estimating one or more unmeasured or unsensed parameters using the data from said sensors and a predictive model of said engine; and generating commands for said actuators based on said state using an optimization algorithm; and transmitting said commands to said engine; wherein said step of generating commands includes simulating said engine in a model; said optimization algorithm is a quadratic programming algorithm (col. 13, lines 20+) adapted to optimize an objective function under a set of constraints; wherein said objective function is based on at least one of said unmeasured or unsensed parameters; wherein optimization algorithm uses a control horizon to optimize said objective function (col. 9, lines 45+); wherein said control horizon is finite; wherein at least one of said constraints is based on at least one of said unmeasured or unsensed parameters; wherein said predictive model is a simplified real-time model (col. 9, lines 5+); wherein said simplified real-time model is a non-iterating, analytic model; wherein said simplified real-time model is a non-linear model which can be linearized.

5. Claims 1-13, 16-32, 35-38 are rejected under 35 U.S.C. 102(e) as being anticipated by Brunell (6,823,253). Brunell teaches a system for controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: a state estimator (EKF) adapted to estimate a state of said engine by estimating one or more unmeasured or unsensed parameters using data from said sensors of said engine for one or more measured or sensed parameters, said estimator including a model of said engine; and a control module adapted to generate commands for said actuators based on said state, said control module including an optimization algorithm (SRTM) for determining said commands; a method of controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: receiving data from said sensors of said engine for one or more measured or sensed parameters; estimating a state of said engine by estimating one or more unmeasured or unsensed parameters using the data from said sensors and a predictive model of said engine; and generating commands for said actuators based on said state using an optimization algorithm; and transmitting said commands to said engine; wherein said step of generating commands includes simulating said engine in a model; wherein said state estimator/step of estimating uses an Extended Kalman Filter (EKF); wherein said Extended Kalman Filter is adapted to correct a mismatch between said model and said engine; wherein said predictive model is a simplified real-time model; wherein said simplified real-time model is a non-iterating, analytic model; wherein said simplified

real-time model is a non-linear model which can be linearized (col. 8, lines 13+); wherein said optimization algorithm is a quadratic programming algorithm (see equations 2, 3 which are quadratic) adapted to optimize an objective function under a set of constraints; wherein said objective function is based on at least one of said unmeasured or unsensed parameters; wherein optimization algorithm uses a control horizon to optimize said objective function; wherein said control horizon is finite; wherein at least one of said constraints is based on at least one of said unmeasured or unsensed parameters.

6. Claims 1-11, 17-32, 36-38 are rejected under 35 U.S.C. 102(e) as being anticipated by Desai et al (6,729,139). Desai et al teach a system for controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: a state estimator 54 adapted to estimate a state of said engine by estimating one or more unmeasured or unsensed parameters using data from said sensors of said engine for one or more measured or sensed parameters, said estimator including a model of said engine; and a control module 56 adapted to generate commands for said actuators based on said state, said control module including an optimization algorithm 56 for determining said commands; a method of controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: receiving data from said sensors of said engine for one or more measured or sensed parameters; estimating a state of said engine by estimating one or more unmeasured or unsensed parameters using the data from said sensors and a predictive model of said engine; and generating commands for

said actuators based on said state using an optimization algorithm; and transmitting said commands to said engine; wherein said step of generating commands includes simulating said engine in a model; wherein said state estimator/step of estimating uses an Extended Kalman Filter; wherein said Extended Kalman Filter 54 is adapted to correct a mismatch between said model and said engine; wherein said predictive model is a simplified real-time model; wherein said simplified real-time model is a non-iterating, analytic model; wherein said simplified real-time model is a non-linear model which can be linearized; wherein said optimization algorithm is a quadratic programming algorithm 56 adapted to optimize an objective function under a set of constraints; wherein said objective function is based on at least one of said unmeasured or unsensed parameters.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 2-6, 14, 15, 21-25, 33, 34 are rejected under 35 U.S.C. 103(a) as being obvious over Brunell et al (6,823,675) or Brunell (6,823,253), in view of each other or singly, and further in view of Ward et al (6,208,914). The Brunell '675 reference teaches the filters but not specifically the EKF. Brunell '253 teach the EKF is a well known filter. It would have been obvious to one of ordinary skill in the art to employ the EKF as

a well known filter for the control system. The Brunell references teaching a finite horizon algorithm and not an infinite horizon. Ward et al teach an infinite horizon control algorithm with infinite horizon tracking error (col. 7, lines 6+). It would have been obvious to one of ordinary skill in the art to employ the an infinite horizon control algorithm with infinite horizon tracking error, as an equivalent technique.

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

9. Claims 1-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Desai et al (6,729,139) in view of Ward et al (6,208,914). Desai et al teach a system for

controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: a state estimator 54 adapted to estimate a state of said engine by estimating one or more unmeasured or unsensed parameters using data from said sensors of said engine for one or more measured or sensed parameters, said estimator including a model of said engine; and a control module 56 adapted to generate commands for said actuators based on said state, said control module including an optimization algorithm 56 for determining said commands; a method of controlling a gas turbine engine, said engine having sensors to detect one or more parameters and actuators adapted to respond to commands, comprising: receiving data from said sensors of said engine for one or more measured or sensed parameters; estimating a state of said engine by estimating one or more unmeasured or unsensed parameters using the data from said sensors and a predictive model of said engine; and generating commands for said actuators based on said state using an optimization algorithm; and transmitting said commands to said engine; wherein said step of generating commands includes simulating said engine in a model; wherein said state estimator/step of estimating uses an Extended Kalman Filter; wherein said Extended Kalman Filter 54 is adapted to correct a mismatch between said model and said engine; wherein said predictive model is a simplified real-time model; wherein said simplified real-time model is a non-iterating, analytic model; wherein said simplified real-time model is a non-linear model which can be linearized; wherein said optimization algorithm is a quadratic programming algorithm 56 adapted to optimize an objective

function under a set of constraints; wherein said objective function is based on at least one of said unmeasured or unsensed parameters. Desai does not teach the horizon based control algorithm. Ward et al teach an infinite horizon control algorithm with infinite horizon tracking error (col. 7, lines 6+) as well as finite horizon control algorithms are old and well known in the art for model predictive systems. It would have been obvious to one of ordinary skill in the art to employ either the infinite horizon control algorithm with infinite horizon tracking error (col. 7, lines 6+) or the finite horizon control algorithms as old and well known in the art for model predictive systems.

Contact Information

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Ted Kim whose telephone number is 571-272-4829. The Examiner can be reached on regular business hours before 5:00 pm, Monday to Thursday and every other Friday.

The fax numbers for the organization where this application is assigned are

571-273-8300 for Regular faxes and 571-273-8300 for After Final faxes.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Thorpe, can be reached at 571-272-4444.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist of Technology Center 3700, whose telephone number is 703-308-0861. General inquiries can also be directed to the Patents Assistance

Center whose telephone number is 800-786-9199. Furthermore, a variety of online resources are available at http://www.uspto.gov/main/patents.htm

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